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Positive Associations Among Dichotic Listening Errors, Complex Partial Epileptic-like Signs, and Paranormal Beliefs

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The numbers of complex partial epileptic-like signs were moderately (*r*s = .50) associated with strength of paranormal beliefs but not conservative (religious) beliefs in a population of young males and females (13 to 20 years). Dichotic listening errors were also significantly correlated with both complex partial epileptic-like signs and paranormal, but not conservative, beliefs; the females demonstrated the strongest intercorrelations (*r*s between .54 and .63). These results support the hypotheses that dichotic listening errors reflect a continuum of complex partial epileptic phenomenology in the normal population and this process encourages the acquisition of paranormal but not traditional beliefs.

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Beliefs are influenced by an interaction between personal experience and the explanations that are available from the sociocultural context (Stevens, 1988). The strength of personal beliefs in paranormal phenomena, such as spiritualism, reincarnation, telepathy, or witchcraft, have been shown to be remarkably frequent (Ross and Joshi, 1992) and to be affected by a variety of psychosocial variables (Brugger et al., 1991; Davies, 1988; Lester et al., 1987; Richards, 1991). Although the neuronal substrates by which human beliefs are mediated are not as yet clear (Persinger, 1979), there is accumulating evidence that electrical activity within the temporal lobes affects the strength of at least paranormal beliefs (Lavallée and Persinger, 1992; Munro and Persinger, 1992; Persinger, 1993a; Persinger and Makarec, 1987, 1992, 1993). This paper reports the first evidence of a moderate association between a neuropsychological index of temporal lobe function (dichotic word listening errors) and the strength of paranormal beliefs within a normal adolescent population.

Strange, mystical, or paranormal experiences and beliefs have been a persistent component of the phenomenological syndrome that accompanies complex partial (limbic) epilepsy (Persinger and Makarec, 1993). Bear (1979) has suggested that the propensity to infuse unusual experiences, ideas, and beliefs with emotional and often cosmic significance is due to sensory-limbic hyperconnectionism. Unusual, odd, or infrequent events would be more likely to trigger anomalous discharges within the amygdaloid nuclei (Halgren et al., 1980) and to facilitate meaningful attribution to those events (Bear et al., 1981). Cumulative (ontogenetic) consequences of these brief but multiple episodes could influence the person's explanation for how the world operates.

Persinger and Makarec (1987, 1993) have suggested that sensory-limbic hyperconnectionism is not unique to limbic epileptic patients but exists as a continuum of temporal lobe sensitivity within the normal population; the concept is the less clinical equivalent of the epileptic spectrum disorder that has been suggested by Richard Roberts and his group (Roberts et al., 1990; Springer et al., 1991; Verduyn et al., 1992). Individuals within the range between the normal person and the diagnosed epileptic patient have been shown to be more suggestible, creative, imaginative, anxious, emotionally labile, and energetic. There has been a consistent correlation (*r*s about +.50) between numbers and varieties of complex partial epileptic-like signs (CPES) in the normal population and the endorsement of major classes of paranormal beliefs (such as telepathy, alien [UFO] intelligence, and reincarnation), but not the endorsement of traditional religious beliefs (Persinger and Makarec, 1987); the dissociation between paranormal beliefs and religious beliefs is not unusual (Davies, 1988; Persinger and Makarec, 1990).

Our general hypothesis was that a moderately strong positive intercorrelation should occur between the strength of the endorsement of paranormal beliefs, CPES, and total numbers of dichotic word listening errors; the latter measures have been positively correlated with CPES (Roberts et al., 1990) and can be attenuated by anticonvulsant medication. Commensurate with the hypothesis, we predicted that traditional religious beliefs should not be significantly correlated with either variable because their contents are not infrequent and are not unusual in context of the culture.

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Method

Subjects

A total of 276 males and females from grades 9 through 13 (Ontario, Canada) in a local high school and from a first-year university arts course served as subjects; there were 23 subjects for each gender and year.

Procedure

In a classroom setting, all subjects were asked to complete Tobacyk's Revised Paranormal Belief Scale (Persinger and Richards, 1991) and a short version of the Personal Philosophy Inventory (Persinger and Makarec, 1987). Tobacyk's scale (supplied by Jerome Tobacyk) consists of 27 items; the subject must endorse a Likert scale (1 to 7) of degree of disagreement or agreement for each item. There are seven subclusters: traditional religious beliefs, psi, witchcraft, superstitions, spiritualism, alien lifeforms, and precognition, as well as a total score. The short version of the Personal Philosophy Inventory consisted of 50 true-false (agree-disagree) items that include 16 CPES items, 15 control items, 6 lie items, and 13 information items.

Ten subjects (five males and five females) from each grade were randomly selected for testing on Roberts' new dichotic word listening test (Auditec, St. Louis, IL). It consisted of 20 monaural words (10 left ear and 10 right ear) that served to discern simple receptive capacity, and 60 dichotic presentations. During testing, the subject wore a pair of stereo headphones and was required to repeat both of the words that were presented on each trial. If the words to either or both ears were missed, the trial was considered an error (potential errors, 0 to 60). (Results from the paper and pencil tests were examined after the dichotic data had been collected.)

All statistical analyses were completed by SPSS. In the first stage of the analysis, factor analyses were completed separately for males and females for the seven subscales of the Tobacyk questionnaire; this was considered appropriate because we assumed there should be substantial shared (redundant) variance between some subscales; two major factors did emerge. Next, intercorrelations between each scale, the two emergent belief factors, and the CPES and control clusters from the short version of the Personal Philosophy Inventory were completed. One-way analyses of variance for these measures as a function of grade and gender were completed in order to compare the results with previous studies.

In the second part of the analysis, intercorrelations between numbers of dichotic listening errors, CPES, and either the Tobacyk scales or the two factors extracted from the scales were completed for the 60 subjects who received the dichotic word listening task. Partial correlations between the CPES, dichotic errors, and the two belief factors, after partialling the variance for the other and/or for grade, gender, and the control scales, were also completed.

Results

The means and standard deviations for the primary measures are presented in Table 1 for all of the males and the females separately. One-way analyses of variance (all *df*s = 1,274) showed no statistically significant differences between any of these measures as a function of grade (age). Whereas there were no statistically significant differences between gender for percentages of complex partial epileptic-like signs, males endorsed more beliefs in life forms than females, while the females held stronger beliefs in precognition and superstition than did the males. The females also displayed significantly higher control (yes) responses than did the males.

The results of the factor analyses (principal component analyses) for the six subscales of the Tobacyk questionnaire for males and females separately are shown in Table 2. After varimax rotation, only two factors emerged for both sexes. As indicated by the factor loadings, the first factor was clearly and uniquely dominated by beliefs in psi, witchcraft, spiritualism, and life forms, while the second factor was loaded primarily by religious and superstitious beliefs. In order to maintain symmetry, we calculated two clusters that represented each of the factors: paranormal beliefs (the mean of the psi and spiritualism subscales) and conservative beliefs (traditional religious and superstitious subscales).

The zero order correlations among the scores of the original Tobacyk scales, the two factors, and the per-

TABLE 1
Means and SD for the Tobacyk (Belief) Scales, Percentage of CPES, and Control Responses for Males and Females Between the Ages of 13 and 20.

	Males (n = 138)		Females (n = 138)		
Variable	Mean	SD	Mean	SD	F
Tobacyk					
Total score	89.4	27.6	94.1	33.7	2.04
Religious	4.6	1.7	4.9	1.6	1.84
Psi	3.5	1.6	3.7	1.3	.46
Witchcraft	3.4	1.7	3.4	1.5	.97
Superstitions	1.7	1.1	2.1	1.4	8.16*
Spiritualism	3.4	1.6	3.7	1.5	3.03
Life Forms	4.0	1.3	3.3	1.2	19.17**
Precognition	3.3	1.4	3.8	1.3	11.94**
Personal Philosophy Inventory					
CPES	35%	21%	33%	20%	.64
Control	74%	10%	77%	11%	6.30*

*$p < 0.05$; **$p < .001$

TABLE 2
Factor Loadings (r Values) and Relevant Measures for the Tobacyk Subscales for Males (N = 138) and Females (N = 138)

	Males		Females	
Variable	Fac1	Fac2	Fac1	Fac2
Religious	.09	.76	−.01	.83
Psi	.82	.19	.85	.06
Witchcraft	.67	.41	.81	−.10
Superstitions	.16	.53	.12	.72
Spiritualism	.80	.38	.80	.27
Life forms	.78	−.30	.70	.42
Precognition	.69	.45	.53	.22
Eigen value	3.72	1.01	3.42	1.31
Percent variance	46.6%	12.7%	42.8%	16.5%

centages of complex partial epileptic-like signs for males and females are shown in Table 3. The CPES were significantly and positively correlated with paranormal beliefs but not with conservative beliefs for both sexes. The partial correlation coefficients did not change by more than .01 to .02 when the variance associated with the control (yes responding) cluster or age was held constant.

The scores for the Tobacyk scales (and factors) as well as the CPES and control measures from the Personal Philosophy Inventory for the 60 subjects who had been randomly selected for the dichotic listening tests were not significantly (ts < 1.50) different from the primary sample. The means and standard deviations for males and females for the various criterion measures were: dichotic listening errors, 9.8 ± 5.7, 11.3 ± 6.3; paranormal beliefs, 3.4 ± 1.7, 4.0 ± 1.6, and conservative beliefs, 3.1 ± 1.1, 3.7 ± 1.2, respectively. There were also no statistically significant differences (Fs < 2.00) for these measures as a function of gender or grade (age). Paired t-test comparisons indicated no statistically significant differences between the mean score for the paranormal or conservative beliefs for either males (t = .69) or females (t = 1.00).

As predicted, there were statistically significant positive intercorrelations among percentage (numbers) of CPES, the strength of endorsement of paranormal beliefs, and the numbers of dichotic word listening error scores (Table 4). However, the strength of endorsement of conservative beliefs was not associated with either CPES or dichotic listening errors. Scattergrams for the association between paranormal and conservative beliefs and dichotic listening scores are shown in Figure 1. Partial correlational analyses indicated a significant contribution from gender (but not age or control responding) to the interrelationships among CPES, strength of paranormal beliefs, and dichotic listening errors.

Consequently, separate analyses were completed for the two sexes. As shown in Table 4, the females were clearly the major source of the statistically significant intercorrelations for these three variables (rs between .54 and .65). The differences between the correlation coefficients for males and females were significant for the associations between dichotic listening errors and CPES (z = 2.03, p < .05), but not for the associations

TABLE 3
Zero Order Correlations between Percentages of CPES and the Tobacyk Scales for Males and Females

Variable	Males	Females
Total beliefs	.44*	.46*
Religious (tradition)	.16	.19
Psi	.41*	.42*
Witchcraft	.31*	.38*
Superstition	.12	.12
Spiritualism	.50*	.39*
Life forms	.21	.19
Precognition	.34*	.33*
Conservative factor	.21	.19
Paranormal factor	.49*	.44*

*p < 0.01.

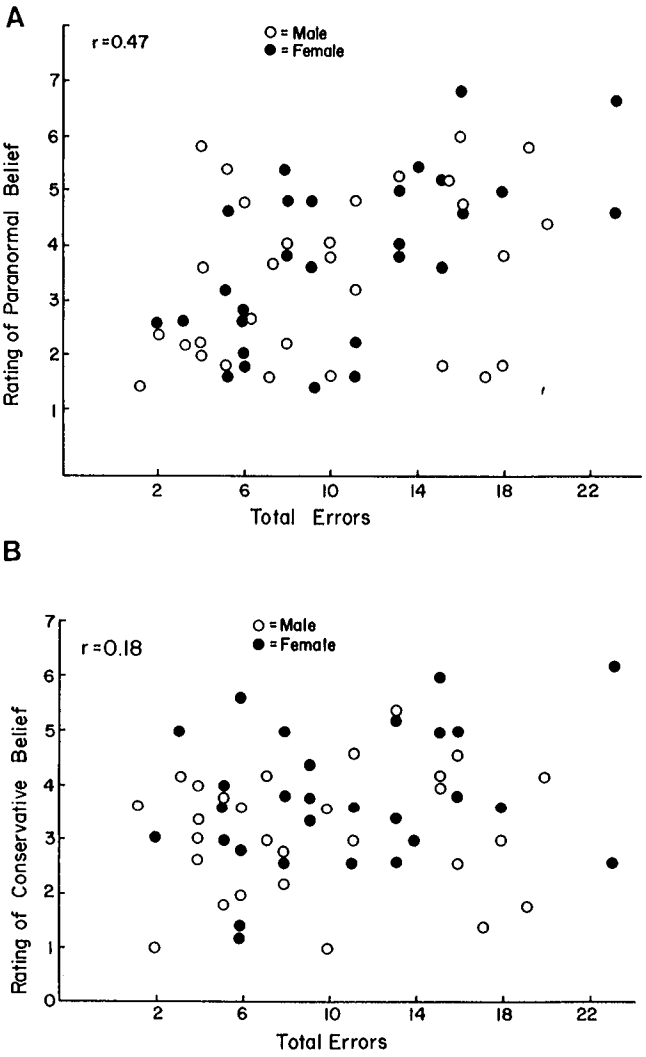

FIG. 1. Strength of paranormal (A) and conservative or religious (B) beliefs as a function of dichotic word listening errors.

TABLE 4
Zero Order and Partial Correlations between Dichotic Listening Errors, CPES, and Paranormal or Conservative (Religious) Beliefs (Females, Males, Both)

	Zero Order				Partial		
Variables	Females	Males	Both	Constant	Females	Males	Both
Dich: Para	.65**	.29	.45**	CPES	.49**	.30*	.37**
Dich: CPES	.54**	.07	.30*	Para	.21	−.10	.03
CPES: Para	.63**	.55**	.60**	Dich.	.43**	.55**	.55**
Dich: Cons	.24	.09	.18	CPES	.20	.09	.14
Cons: CPES	.14	.09	.14	Dich.	.01	.09	.10
Cons: Para	.28	.46*	.40**	Dich.	.15	.46*	.36*
Dich: Para	.65**	.29	.46**	Cons	.63**	.27	.43**

*$p < .05$; **$p < .01$.

between dichotic listening errors and paranormal beliefs ($z = 1.85$, $.05 < p < .10$). The only loss of statistical significance occurred between dichotic listening scores and CPES after paranormal beliefs had been covaried.

Discussion

These results indicated that dichotic listening errors are positively associated with indices of the range of subjective experiences that are also reported by patients who display verified complex partial epilepsy (Persinger and Makarec, 1993). This positive association between complex partial epileptic-like experiences and numbers of dichotic listening errors has been reported for normal university students (Lavallée and Persinger, 1992) and for patients (Roberts et al., 1990) who do not display classic stereotyped movements or epileptiform electroencephalographic profiles. These results suggest the existence of a continuum of electrical lability within the temporal lobes that can adversely affect dichotic listening efficiency.

This spectrum of electrical lability may be one indicator of the consequences of sensory-limbic hyperconnectionism (Bear, 1979). Because of this enhanced functional association, strange or unusual experiences or ideas are infused with greater than average emotional significance and gradually shape acquisition of concordant beliefs. However, this same process could interfere with the efficiency of binaural auditory discrimination because of the increase of the affective "noise" in the signal/noise quotient during the processing (Persinger, 1933a, 1933b). The positive association among complex partial epileptic-like experiences, dichotic listening errors, and the strength of the endorsement of paranormal beliefs supports, but does not prove, this hypothesis.

That the people who displayed more dichotic word listening errors are not simply endorsing any belief or experience was indicated by the absence of statistically significant correlations between these errors and control experiences and the strength of traditional religious beliefs. The content of this factor, which was loaded primarily by traditional religious ideas and mundane superstitions, is neither infrequent nor strange within our culture. These beliefs are more likely to be acquired by intraverbal processes (Skinner, 1957) or by modeling cultural explanations rather than (primarily) by personal experiences (Persinger, 1993b).

Clearly the major source of the statistically significant intercorrelations among CPES, dichotic errors, and paranormal beliefs originated from the female subjects. Because there were no statistically significant differences between this sample of males and females for CPES, paranormal beliefs, religious beliefs, or dichotic word listening errors, the issue does not involve which gender is better or worse on these dimensions. Instead, the results suggest that the neurocognitive processes by which a) beliefs have been acquired and b) the phenomenology of CPES has occurred, differ between sexes. This supports previous research that the intercorrelations between variables within the domain of imagination, suggestibility, and beliefs differ between men and women (Bowers and Bowers, 1972; Persinger, 1991).

These results do *not* invoke necessarily a model of pathology. Because this population would not be considered clinically impaired, the most objective interpretation of the results is that people who display more dichotic processing anomalies are more prone to report stronger paranormal beliefs and CPES. Recent experiments by Gilbert et al. (1990) have indicated that disruption of the "refutation process" increases the probability that a person will accept novel statements as being true. Young people who display more frequent CPES and less efficient dichotic word processing would be more likely to accept exotic experiences or statements as being true rather than false. On the other hand Persinger and Makarec (1991) noted that a person's beliefs about paranormal phenomena may facilitate logical solutions that contain anomalous content. These individuals might simply perceive the world differently. From this context, the positive association between numbers of complex partial epileptic signs,

creativity, and nontraditional ideas and their role in scientific discovery might also be considered.

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